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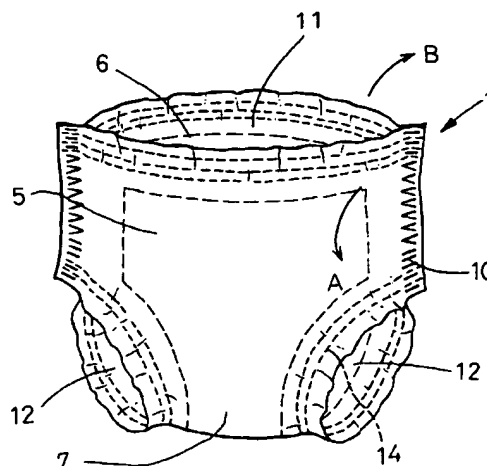
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⑤④ **Disposable diaper.**

⑤⑦ A disposable diaper (1) of pants type has front and rear bodies (5, 6) bonded to each other by a series of welded zones (10) along transversely opposite sides of front and rear waist sections. The welded zones (10) are at least partially defined by patterns of V-shape or patterns of V-shape being devoid of a sharp point, both laid down transversely of the diaper, or patterns of an arc opening transversely of the diaper.

**FIG.1**



The present invention relates to a disposable diaper, more particularly to pants-type disposable diaper.

It is well known for pants-type disposable diapers comprising heat-weldable top- and backsheets to seal front and rear bodies to each other by means of heat welding along transversely opposite sides of front and rear waist sections. For example, Japanese Laid-Open Patent Application No. 1993-15551, of which the applicant is the same as the applicant of the present application, discloses a sealing technique for pants-type diapers, by which a series of intermittent rectangular welded zones each having a long side extending in parallel to a waist line of the diaper are longitudinally arranged along each lateral side of the front and rear waist sections utilizing an ultrasonic welding. Use of this technique enables the diaper put on a wearer to be easily stripped off merely tearing off the diaper along the sealed side edges of the diaper. This technique is advantageous also in that the interior of the diaper is always maintained in good communication with the exterior of the diaper and thereby a diaper of high air-permeability is obtained.

Tearing off tends to take place along a peripheral edge of each welded zone as the diaper is torn off. The sheets usually used to form the diaper comprise a thin nonwoven fabric or a plastic film of a relatively small weight per unit area and a correspondingly low tear strength, since, after the sheets have been welded to each other, the welded zone exhibits a tear strength higher than that exhibited by the nonwelded zone and a tearing force is concentrated along a boundary between the welded zone and the nonwelded zone. Consequently, there is an apprehension that a tear might progress circumferentially, i.e., transversely into the front and/or rear bodies as the diaper is torn off along the long side of each rectangular welded zone, instead of being torn longitudinally of the diaper. Such undesirable phenomenon will readily occur particularly when both the top- and backsheets have a tear strength in the transverse direction significantly lower than a tear strength in the longitudinal direction. Unless the diaper is torn off in the longitudinal direction, it will be impossible to relieve the wearer from the diaper as quickly as possible.

Accordingly, a principal object of the invention to solve the problem as has been mentioned above by providing a diaper with welded zones at least partially defined by patterns each having contours diverging transversely of the diaper so that the diaper may be easily torn off along such contours obliquely downwards.

To achieve the object set forth above, the invention broadly resides in a disposable diaper comprising a liquid-permeable topsheet, a liquid-impermeable backsheet sandwiched between these two heat-weldable sheets, and having front and rear bodies sealed to each other along transversely opposite

sides of front and rear waist sections, defined by portions extending outwards from transversely opposite side edges of said liquid-absorbent core in said front and rear bodies by series of intermittent welded zones arranged longitudinally along the respective waist side portions.

The invention is characterized in that the welded zones are at least partially defined by patterns each having an outer contour formed substantially in a V-shape laid down transversely of the diaper, or said outer contour comprising that of an arc opening transversely of said diaper as a modified form thereof.

With the disposable diaper constructed as has been described above, the top- and backsheets are torn off obliquely along contours of each welded zone diverging transversely of the diaper, instead of being torn off circumferentially of the waist, as the waist side portions are torn off.

The invention will be readily apparent from the following description of preferred embodiments with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view showing a disposable diaper according to an embodiment of the invention;

Fig. 2 is a perspective view showing the diaper as developed in longitudinal direction;

Fig. 3 is a fragmentary plan view showing an embodiment of welded zones in the diaper in an enlarged scale;

Fig. 4 is a view similar to Fig. 3 showing another embodiment of the welded zones;

Fig. 5 is a view similar to Fig. 3 showing yet another embodiment of the welded zones; and

Fig. 6 is a view similar to Fig. 3 showing a still further embodiment of the welded zones.

Referring to Figs. 1 and 2, a blank 1A of a diaper 1 comprises a liquid-permeable topsheet 2, a liquid-impermeable backsheet 3 and a liquid-absorbent core 4 sandwiched between these two sheets 2, 3, and is generally composed of a front body 5, a rear body 6 and a crotch zone 7. The topsheet 2 is formed by a nonwoven fabric of thermoplastic fibers, the backsheet 3 is formed by a thermoplastic film, and these two sheets 2, 3 are heat-weldable to each other. Referring to Fig. 2, portions of the top- and backsheets 2, 3 extending outwards from the peripheral edge of the liquid-absorbent core 4 are intermittently bonded to each other by means of adhesive (not shown) in the diaper blank 1A. The diaper blank 1A may be folded inwards in two along a longitudinally middle line X - X and transversely opposite side edges of the front and rear bodies 5, 6, formed by portions of the top- and backsheets 2, 3 extending outwards from transversely opposite side edges of the liquid-absorbent core 4 and lying one upon another, may be sealed together by series of respective side edges to form the diaper 1 into pants type. The diaper 1 thus formed has a waist-opening 11 and a pair of

leg-openings 12. These openings 11, 12 are provided along their peripheries with a plurality of parallel elastic members 13, 14 bonded to said peripheries, respectively, in their stretched condition.

Referring to Fig. 3, the elastic members 13 shown in the upper portion of the waist side edge are associated with the waist-opening 11 and the elastic members 14 shown in the lower portion of the waist side edge are associated with the leg-openings 12. The welded zones 10 comprise first rectangular welded patterns 17 intermittently provided between each pair of adjacent elastic members 13 for the waist-opening and adjacent the uppermost elastic member 13 and having their long sides 17A extending in parallel to the elastic members 13, second rectangular welded patterns 18 intermittently provided between each pair of adjacent elastic members 14 for the leg-openings and adjacent the lowermost elastic member 14 and having their long sides 18A extending in parallel to the elastic members 14, and third laid down V-shaped welded patterns 19 intermittently provided between the lowermost elastic member 13 and the uppermost elastic member 14. Each of said first and second welded patterns 17, 18 is a rectangular welded zone dimensioned to be 0.3 to 2mm X 3 to 10mm- (height X length) and each of the third welded patterns 19 is a V-shaped welded zone described by a welded line being 0.3 to 1.5mm wide and dimensioned to have an included angle  $C = 15$  to  $90^\circ$  and a length  $D = 3$  to 10mm. All of the welded patterns 17; 18, 19 are spaced by  $d = 0.5$  to 3mm one from another and non-welded zones defined between each pair of adjacent patterns contribute to promote a fluid communication between the interior and exterior of the diaper, improving the desired air-permeability of the diaper.

With the diaper 1 shown by Fig. 1, the diaper 1 can be torn off longitudinally down along the welded zones 10 by pulling the front and rear bodies 5, 6 in directions as indicated by arrows A, B with the waist-opening gripped in the hands and thereby a wearer can be easily relieved from the diaper 1. The welded zones 10 of the diaper 1 generally have a tear strength higher than that of the top- and backsheets 2, 3, so the top- and backsheets 2, 3 are torn off along the outer peripheries of the first, second and third welded patterns 17, 18, 19 as the front and rear bodies are pulled in the directions A, B. In other words, the top- and backsheets 2, 3 tend to be torn off transversely along the first and second welded patterns 17, 18 and tend to be torn off in a V-shape along each of the third welded patterns 19 and thereby to be torn off obliquely downwards in a zigzag along the series of V-shaped patterns 19. Particularly when fibers and/or polymers in the top- and backsheets 2, 3 are oriented transversely of the diaper 1 and these sheets 2, 3 tend to be torn off transversely of the diaper due to such orientation, there is an apprehension

that the sheets 2, 3 might be torn off along the first and second welded patterns 17, 18 into the front and/or rear bodies. However, according to this embodiment of the diaper 1, the first and second welded patterns 17, 18 are located as adjacent as possible to the elastic members 13 for the waist-opening and the elastic members 14 for the leg-openings so that such apprehension may be minimized and the major portions of the respective waist side edges are sealed only by the third welded patterns 19 so that the top- and backsheets 2, 3 may be easily torn off longitudinally but not transversely of the diaper 1. While it is possible to replace the first and second welded patterns 17, 18 by the third welded patterns 19, the V-shaped patterns 19 might cross and cut the elastic members 13, 14 or the elastic members 13, 14 might impede quick welding of the top- and backsheets 2, 3 depending on the distance by which the elastic members 13, 14 are spaced one from another, respectively.

Figs. 4, 5 and 6 are views similar to Fig. 3 showing various embodiments of the third welded pattern 19. Referring to Fig. 4, the laid down V-shaped third welded pattern 19 diverges towards the center of the diaper 1. The V-shape may be devoid of its sharp point. Referring to Fig. 5, the third welded pattern 19 is an arc opening transversely of the diaper 1 and its orientation is alternated, which is a modified form of the V-shaped pattern 19 shown in Figs. 3 and 4. Referring to Fig. 6, the third welded pattern 19 is a rhombus formed by two laid down V-shaped contours one of which diverges towards the center of the diaper 1 and the other diverges in the opposite direction. While the third welded patterns 19 may be continuous one to another, instead of being intermittently arranged as exemplarily shown by Figs. 3 through 6, such continuous arrangement of the third welded patterns 19 will deteriorate the air-permeability of the diaper 1.

According to the invention, the heat-weldable top- and backsheets 2, 3 may be subjected to embossing or ultrasonic welding to obtain the first, second and third welded patterns 17, 18, 19. The top-sheet 2 may be formed by a nonwoven fabric made of thermoplastic fibers or a porous thermoplastic film and the backsheet 3 may be formed by a thermoplastic film, a nonwoven fabric or a laminate of a nonwoven fabric and a plastic film. The liquid-absorbent core 4 may be formed by the well known materials conventionally used for this component.

In the disposable diaper according to the invention, the front and rear bodies are welded together along the transversely opposite side edges of the front and rear waist sections and this welding is achieved by the welded zones comprising the intermittent patterns each having contours of V-shape or V-shape devoid of its sharp point, both laid down transversely of the diaper or patterns each having contours of circular arc opening transversely of the dia-

per. Accordingly, when the diaper is torn off along the waist side edges to relieve a wearer from the diaper, the top- and backsheets are torn off obliquely downwards along said contours rather than being torn off circumferentially of the waist. In this manner, no failure of tearing off occurs.

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## Claims

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1. A disposable diaper comprising a liquid-permeable topsheet (2), a liquid-impermeable backsheet (3) and a liquid-absorbent core (4) sandwiched between said sheets (2, 3) which are heat-weldable, and forming front and rear bodies (5, 6), said front and rear bodies (5, 6) providing front and rear waist sections having transversely opposite side portions defined by portions extending outwards from transversely opposite side edges of said liquid-absorbent core (4), said front and rear bodies (5, 6) being sealed to each other along said side portions by a series of intermittent welded zones (10) arranged longitudinally along the respective side portions, characterized in that said welded zones (10) are at least partially defined by patterns (19) each having an outer contour formed substantially in a V-shape laid down transversely of the diaper or an arc shape opening transversely of said diaper.

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2. A disposable diaper according to claim 1, wherein said outer contour is devoid of the sharp point of the V-shape.

3. A disposable diaper according to claim 1 or 2, including elastic members (13, 14) provided along peripheries of the waist and leg openings (11, 12) of the diaper and wherein said welded zones (10) are provided between the lowermost one of the elastic members (13) provided along the peripheries of the waist-opening (11) and the uppermost one of the elastic members (14) provided along the peripheries of the leg-openings (12).

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4. A disposable diaper according to claim 3, wherein said welded zones (10) include further patterns (17, 18) intermittently provided between the elastic members (13, 14).

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5. A disposable diaper according to claim 4, wherein said further patterns (17, 18) are each substantially rectangular in shape.

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**FIG. 1**

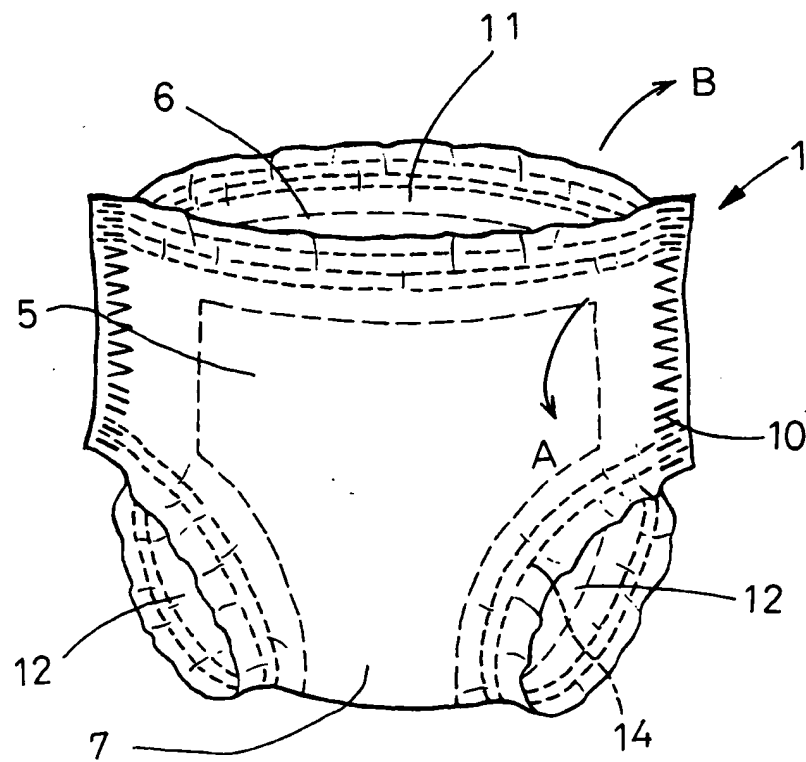


FIG.2

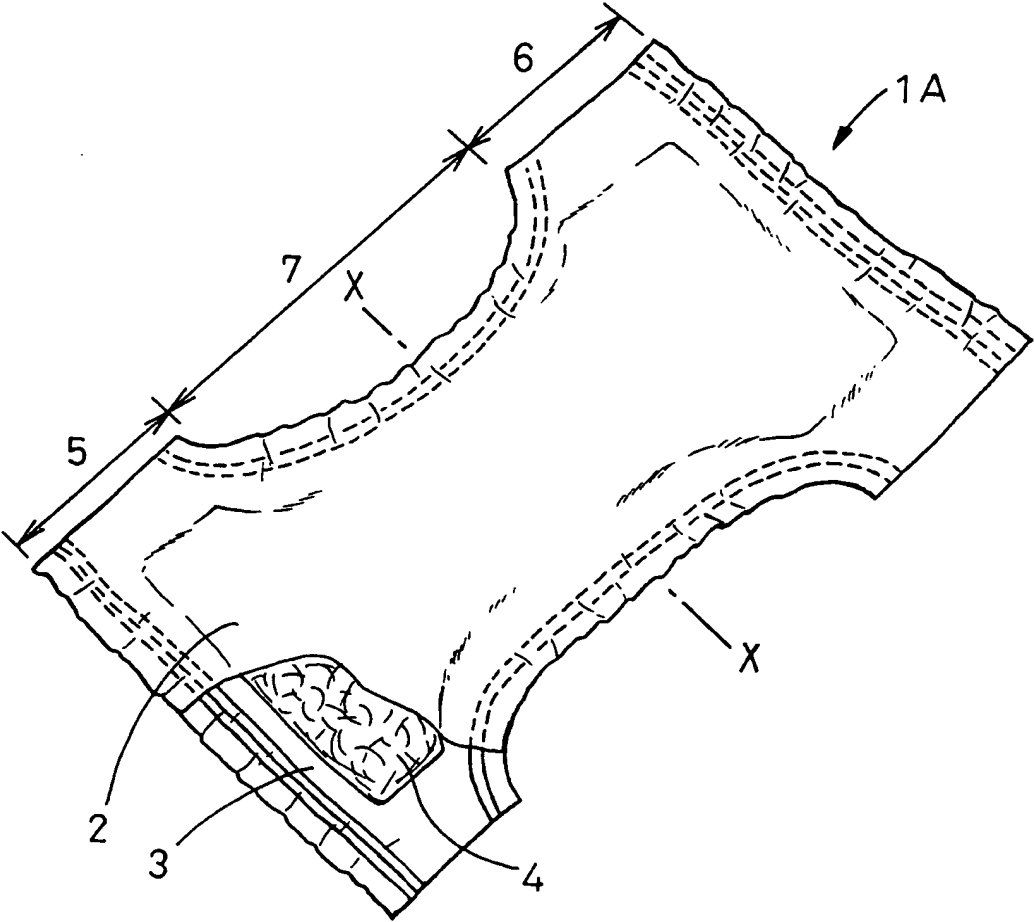


FIG.3

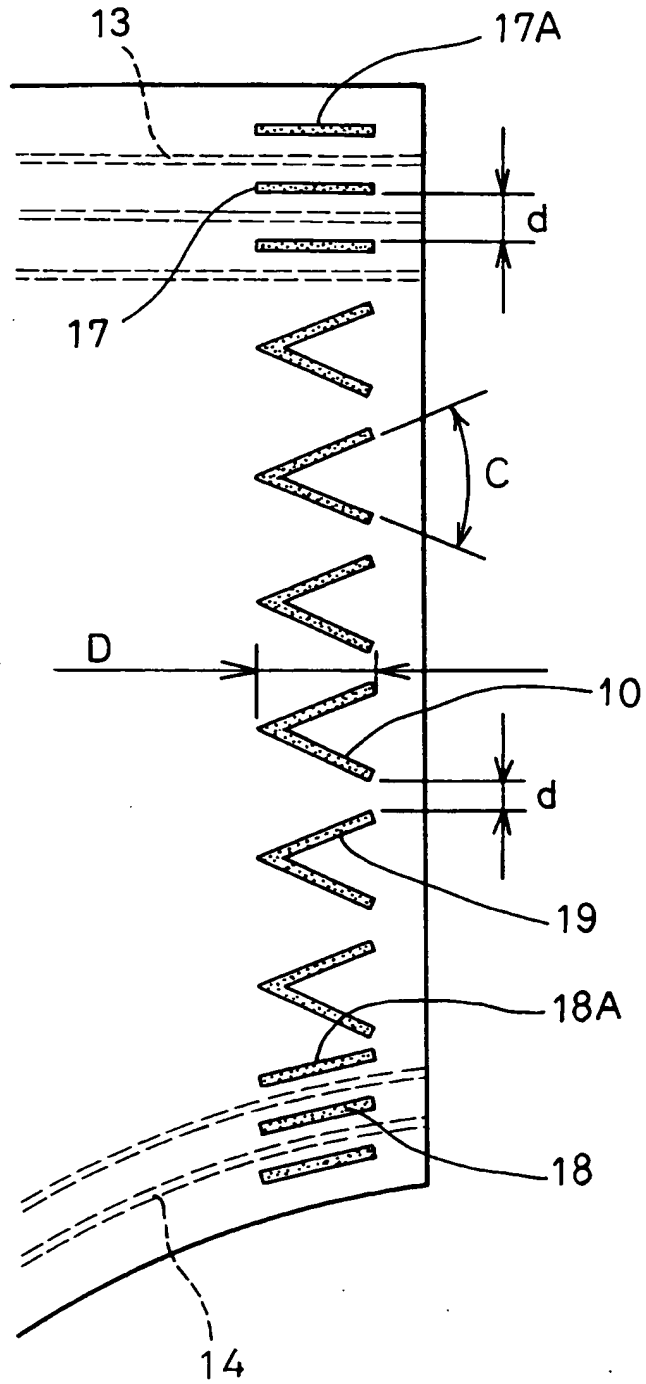


FIG.6

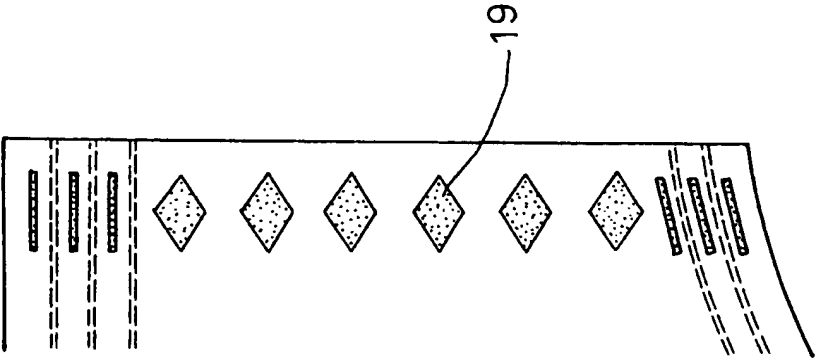


FIG.5

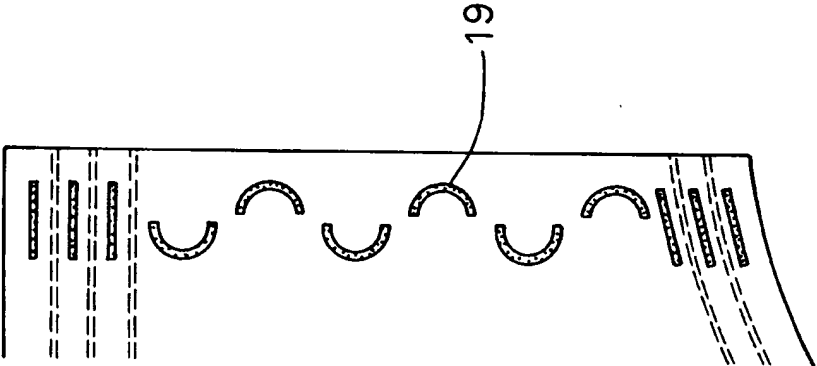
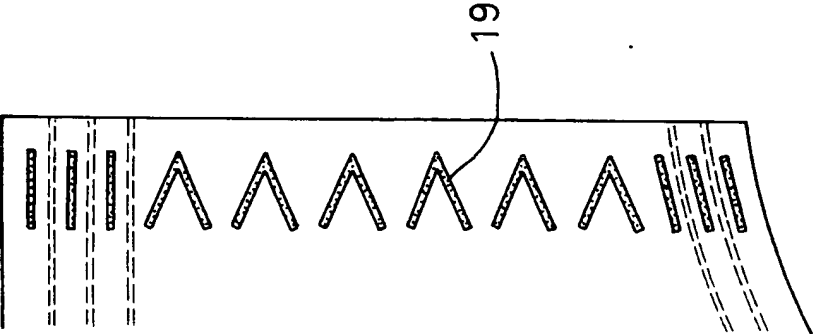


FIG.4







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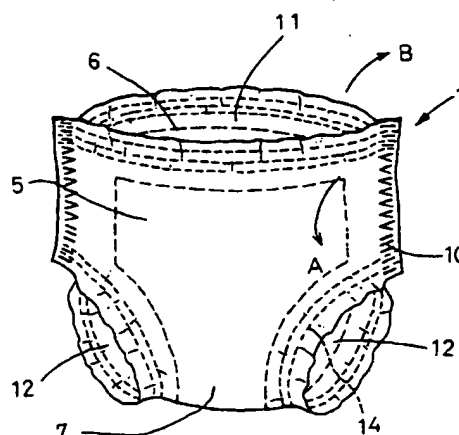
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**FIG.1**





European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 94 30 9157

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A D,A	EP-A-0 531 666 (UNI CHARM) * abstract; figures * & JP-A-05 015 551 (UNI CHARM) -----	1	A61F13/15
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A61F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 4 July 1995	Examiner Hagberg, A
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons ***** &amp; : member of the same patent family, corresponding document</p>			

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